Choosing Technologies for ODL in a Developing Country: Efficiency and Efficacy issues

Theme: Formal education

Sub-theme: **Technologies for Scaling up ODL programmes**

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Abstract

Choosing appropriate technology for open and distance learning (ODL) system is most important and highly discussed issue in the recent years. While adopting more and more technologies is required to squeeze the so-called *quality gap* between conventional classroom teaching and off-campus open and distance learning, it is equally important to consider the efficiency issues concerned with adopting a new technology – this paradoxical situation fits well with the realities in the developing countries. Although the inevitability of the adoption of educational technologies in ODL can no longer be questioned, costs for the adoption of a new technology must not be neglected from efficiency point of view. Especially, in the resource poor developing countries, adoption of inappropriate technologies must create wastage of resources, incur huge maintenance costs and end up with quality shirking in the programmes.

This paper aims at explaining the efficiency and efficacy issues concerning the adoption of new technology for ODL in a developing country. To do that, the paper highlights some criteria that may be taken into consideration. The paper offers SMAARTE criteria that can be used in choosing a technology for ODL. The paper also verifies the appropriateness of the technologies presently used in the SSC programme of Bangladesh Open University (BOU) in the light of SMAARTE criteria. A comparison has been made between the technology choice for secondary level and that for graduate level programmes of BOU to show that not all technologies are equally appropriate for all programmes. The role of local, regional and global partnerships on technology sharing has been carefully verified in the paper to expand the use of technologies by BOU learners.

Keywords: New technology, Technology choice, SMAARTE criteria, ODL, Developing country, Collaboration/partnership.

1. Introduction

The revolution of information technology use is very significant than any previous revolution (Taylor, 1999). It has been estimated that the internet reached 50 million users in 5 years compared with radio that took 38 years to reach the same number, and television which took 13 years to reach 50 million users (Hayes, 1998). The coverage of technology is very high (for example, a fibre optic cable can now carry 1.5million conversations simultaneously) and thus the economy of scale can be exploited when technology is adopted. Also, the cost of access to information communication technologies continues to fall (Woodall, 1997c: the cost of computer power in 1997 only .001% of what it did in the early 1970s; Bill Gates told the Senate Judiciary that 'the cost of computing has decreased 10 million fold since 1976). Therefore, adoption of technology is beneficial for an institution in economic sense at least in the short run. Technology can play a very crucial role in ODL system. To enhance the effectiveness and the quality of ODL programmes, it is widely agreed that necessity to adopt technologies is sky rocketed. Technologies can squeeze the so-called quality gap in ODL as compared to the conventional on-campus education system by enhancing teacher-student interaction. That means, adoption of technology can make the ODL programmes both effective in terms of quality and efficient in terms of cost sharing. Opportunities of economies of scale can be exploited much in the ODL programmes if technologies are

used in delivery of the educational materials. However, it is also paradoxically evident that inappropriate adoption of a new technology sometimes causes permanent cost increase, wastage of human and economic resources and unfortunate *quality shirking* in the programmes - leaves some *white elephants* for the institution. This situation fits very well with the reality of the developing countries. In the process of gulping the futile imported development syrup advised by the ODL consultants or to show up with some conspicuous updates of the system or to fulfill the commitments to the donors of educational aid, ODL institutions in the developing countries adopt some unnecessary technologies that cause some permanent financial burden on their shoulders. We must be careful in adopting a technology. We shouldn't use technology for the sake of technology. Choosing a technology wrongly not only the institution creates an unnecessary financial burden for it but also the students will be impacted/suffered by the wrong technology choice constantly. It is very important to make the best decisions possible in choosing a technology. We must remember that a technology choice can speed up the students' learning, or slow it down. It can transparently support an activity or can create a barrier in the way of its completion. It can make their experience richer, or frustrate them and cause them to question why the technology was ever selected. Therefore, when choosing what technology to use to deliver a course at a distance, there are a wide variety of items to consider. Careful thought and attention to these topics before introducing a technology will ensure that the technology will meet the objectives of the course, will be viable for institution, will be convincing to the instructor, and most importantly, to the students.

This paper explains the efficiency and efficacy issues concerning the adoption of new technology for ODL in a developing country. In that connection, the paper offers SMAARTE criteria that may be considered while choosing a technology for ODL or test whether a technology already chosen for ODL is appropriate or not in a developing country. Then, the paper verifies the appropriateness of the technologies presently used in the SSC programme of Bangladesh Open University (BOU) in the light of SMAARTE criteria. A comparison has been made between the technology choice for secondary level and that for graduate level programmes of BOU to show that not all technologies are equally appropriate for all programmes. The role of local, regional and global partnerships on technology sharing has also been carefully mentioned in the paper.

2. Objectives

The objectives of the paper are:

- To describe the features of ODL technologies
- To sketch the advantages and disadvantages of the ODL technologies
- To explain the efficacy and efficiency issues (appropriateness) of ODL technologies
- To identify some criteria to be followed while adopting a technology for ODL
- To check the appropriateness of technologies used in BOU's programmes
- To propose the alternative ways to enhance the technology use in BOU programmes

3. Methodology

Both primary and secondary data have been used in the paper. For primary data, a group of randomly selected stakeholders including learners and tutors have been interviewed through a structured questionnaire. Twenty learners of SSC and 20 of CEMBA program have been randomly selected. In the case of SSC programme, ten learners from rural area and 10 from urban area have been interviewed. For secondary data, the published reports and data by students support services division and examination division of BOU as well as the reports of Bangladesh Bureau of Educational Information and Statistics (BANBEIS) have been used. Most of the analyses in the paper have been done on the basis of tables and charts constructed from the data collected. Some descriptive statistics have also been used in the analysis.

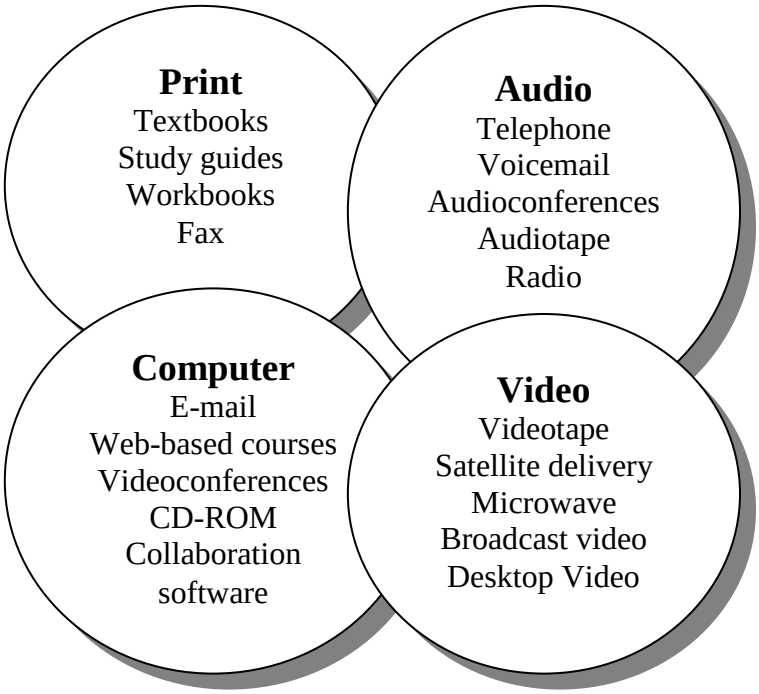
4. ODL Technologies

Since the great revolution of information technologies, a number of technologies are readily available for ODL system. Some institutions in the developed world are trying to benefit from the new technologies in combination with the traditional technologies. New information technologies are widely used in ODL to enhance the virtual reality environment.

4.1. Groups of ODL Technologies

There are 4 interrelated groups of technologies that can be used in ODL. These are: print, audio, video and computer. Print technology includes textbooks, study guides, workbooks, fax, etc. Audio technology includes telephone, voicemail, audio-conference, audiotape, radio, etc. video technology includes video tape, satellite delivery, microwave, broadcast video, desktop video, etc. Computer technology includes web-based courses, video-conference, CD-ROM, collaboration, software, etc. Figure-1 below shows the groups of ODL technologies.

Figure-1: Groups of ODL Technologies



4.2. Characteristics of ODL Technologies

ODL technologies do have some differences in terms of their delivery characteristics, sophistication level and absorbing instructional strategies. A technology may be appropriate for synchronous delivery while other may be appropriate for asynchronous delivery of ODL courses. For example, with two-way videoconferences, students interact with "live" video of an instructor. Less complex technologies, such as telephone conversations, are also synchronous. In these cases, the teacher and the student interact with each other in "real time." Conversely, in the case of asynchronous delivery, the teacher may deliver the instruction via video, computer, or other means, and the students respond at a later time. For example, instruction may be delivered via the Web or videotapes, and the feedback could be sent via e-mail messages. The variations among the ODL technologies are outlined in Table-1 below.

Table-1: Characteristics of ODL Technologies

Technologies	Synchronous	Asynchronous	Sophistication Level	Instructional strategy (where this technology can be used?)
Print		✓	Low	L, T, ASN, ACT, ASN, CM, PL
Videoconference	✓		High	L, LGD, SGD CS, BS, CM, T, INTV, DEMN, LE
Audioconferencing	✓		Medium	L, LGD, SGD, PL, BS, CS, T, INTV
Videotapes		✓	Low	L, CS, DP
Broadcast video, TV		✓	High	L, T
Video CD-ROM		✓	Medium	L, CS, DP
Audiotapes		✓	Low	L, CS, DP
Broadcast Audio/radio		✓	High	L, T
Audio CD-ROM		✓	Medium	L, CS, DP
Computer videoconference	✓		High	L, LGD, SGD CS, BS, CM, T, INTV, DEMN,
Web-based education		✓	High	L, T, R, CM, LE, RP,
Internet chat	✓		High	SGD, PL, BS, T, INTV,
E-mail		✓	Low	L, SGD, PL, BS, CS, T, R, RP, ASN
Telephone	✓		Low	SGD, PL, BS, T, INTV,
Voicemail		✓	Medium	SGD, PL, T

Note: ACT-Activity, ASN-Assignment, BS-Brain storming, CM-Concept mapping, CS- Case study, DEMN-Demonstration, DP-Drill and practice, LGD-Large group discussion, SGD- Small Group Discussion, INTV-Interview, L- Lecture, LE-Laboratory experiences, PL-Peer learning, R-Research, RP-Role playing, T- Tutorials

4.2. ODL Technologies by Coverage

ODL technologies fall into different categories in terms of their coverage. The coverage of the technology is shown in Table-2. Here, coverage of technology indicates the connection/delivery between the organizers and the receivers/learners, such as, one-to-one, one-to-many, few-to-few, and many-to-many. The connections/delivery can be asynchronous or synchronous.

Table-2: ODL Technologies by Coverage

Technologies	Synchronous	Asynchronous	Coverage	
			Organizers	Receivers
Print		✓	One	Many
Videoconference	✓		One	Many
Audio-conferencing	✓		Few	Few
Videotapes		✓	One	Many
Broadcast video, TV		✓	One	Many
Video CD-ROM		✓	One	Many
Audiotapes		✓	One	Many
Broadcast Audio/radio		✓	One	Many

Audio CD-ROM		✓	One	Many
Computer videoconference	✓		Few	Few
Web-based education		✓	Few	Few
Internet chat	✓		Many	Many
E-mail		✓	Many	Many
Telephone	✓		One	One
Voicemail		✓	Many	Many

4.3. Advantage and Disadvantages of ODL Technologies

Every technology has advantages and disadvantages. It is always important to understand the merits and demerits of a technology before adopting it. The Table-3 summarizes the advantages and disadvantages of the major ODL technologies.

Table-3: Advantage and disadvantages of ODL Technologies

Technologies	Advantages	Disadvantages
Print	Materials inexpensive Portable High comfort level Readily available	No interactions Limited sensory involvement Requires reading skills Time delay
Voicemail	Low cost Easy to use Increases interactions	Length may be limited No visual cues May involve toll charges
Audiotape	Inexpensive Easily accessible Easily duplicated	No visual cues No interaction
Audio-conference	Inexpensive Easy to set up	No visual cues No interaction Requires hardware
E-mail	Flexible Interactive Convenient	Requires hardware Software variations
Online Chat	Real-time interactions Instant feedback	Requires similar software Must be scheduled Requires hardware
Web-based Education	May incorporate multimedia Worldwide access Interactive	Requires computer Requires Web access May be slow
Videotape	Inexpensive Easily accessible Easily duplicated Audio and visual elements	Complex to record No interaction Requires hardware
Cable/Broadcast Television	Easy to use Easily accessible May be videotaped Includes audio and visual	High production costs Requires hardware No interaction Must be scheduled

5. SMARRTE Criteria for technology Choice for ODL

In the previous sections, it has been shown that ODL technologies offer a wide range of benefits in teaching-learning environment. However, a number of factors must be considered during adoption of a technology to maximize the benefits out of them. Here a set of criteria, SMAARTE, have been proposed to judge the appropriateness of a technology while planned to adopt it into ODL system. The criteria can

also be used to check the appropriateness of an existing ODL technology. The SMARRTE criteria have been designed considering the possible efficacy factors and efficiency factors concerned with ODL technologies. According to the **SMAARTE** criteria, choosing a technology may be considered as appropriate if it fits the following criteria: **S**oftness, **M**anageability, **A**ffordability, **A**ccessibility, **R**eliability, **T**otality and **E**fficiency. Thus, the acronym SMAARTE has been formed by taking the first letters of the seven criteria above. The explanations of the criteria have been mentioned in Table-4 below.

Table-4: SMAARTE Criteria for Choosing ODL Technology

Criterion	Explanation
Softness	• The technology must be easy, handy, can be accessed anywhere. • Support facilities to the technology are readily available. • Can easily be modified or changed or expanded if required with low costs. • Flexible - it can be used on an individualized basis. • It fits well to the learning context.
Manageability	• The technology can be maintained easily. It doesn't require huge and expensive supporting devices. It is almost a stand-alone technology. • Required support staffs and facilities are available. • Locally repairable & Transferable.
Affordability	• The technology must be cheaper so that the learners can use it. • Less or no system dependence, It is friendly to local conditions and adaptive. • It must not cause extraordinary financial burdens on the learners.
Accessibility	• The infrastructure is widely established and any learner can access from anywhere. • Learner is ready to use it.
Reliability	• The technology should be trustworthy. Individual learner can maintain confidentiality while interact with teacher. The teacher can use it to meet the individual learner's need. • It doesn't contain any image that is conflicting to the pride and dignity of the learners.
Totality	• The technology can be used to bridge the educational quality divide between rural and urban areas. It helps the learners of both rural and urban areas equal access to knowledge and information. • All sections of people can be brought into its coverage. It is well accepted by people of all generations. It provides benefits to more users at a time.
Efficiency	• Average cost for the technology use decreases as the number of users increases. It doesn't cause huge extra financial burden for the user.

A numerical scale is to be used for quantifying the attributes in the proposed criteria. Scale ranges from 0 to 5. If a technology does not at all satisfy the attributes of a criterion, 0 is used for that. 1 is used if the technology satisfies the attributes of the criterion poorly. 2 is used for if the technology satisfies the attributes fairly, 3 if the technology meets the criterion better, 4 if the technology is nearly perfect to meet the criterion and 5 is used if the technology meets the criterion perfectly.
Then for the judgment on the appropriateness of a technology, weighted average of all the scores against various criteria is to be used. The weighted average of the scores is considered here as Appropriate Technology Index (ATI). Weights must carefully be designed based of the social, cultural, economic and learning contexts. Therefore, weights against the criteria should not be static for all societies. The following formula is to be used for calculating ATI or weighted average of the scores:

$$\bar{S} = \sum_{i=1,j=1}^{6} S_i W_j \Big/ \sum_{j=1}^{6} W_j$$

Here, $\bar{S}$ = average score/ATI, S_i=individual scores, W_j=weights.
ATI ranges from 0 to 5. Now based on ATI, judgment can be made on the appropriateness of an ODL technology. Table-5 below summarizes that.

Table-5: ATI and the Appropriateness of ODL Technology

Magnitude of ATI	Judgment on the appropriateness of ODL technology
$\bar{S}$=0	Not appropriate
0< $\bar{S}$ ≤2.5	Least appropriate
2.5< $\bar{S}$ ≤3.5	Fairly appropriate
3.5< $\bar{S}$ ≤4.99	Appropriate
$\bar{S}$=5	Perfectly appropriate

6. ODL Technologies used at Bangladesh Open University (BOU)

Bangladesh Open University presently uses a few technologies in its educational delivery. It mostly relies on print. Audio-Visual technologies such as radio broadcasts and TV broadcasts are used in limited form

as supplementary to print. Table-6 below shows the use of ODL technologies at various programmes of BOU.

Table-6: Use of ODL Technologies at BOU

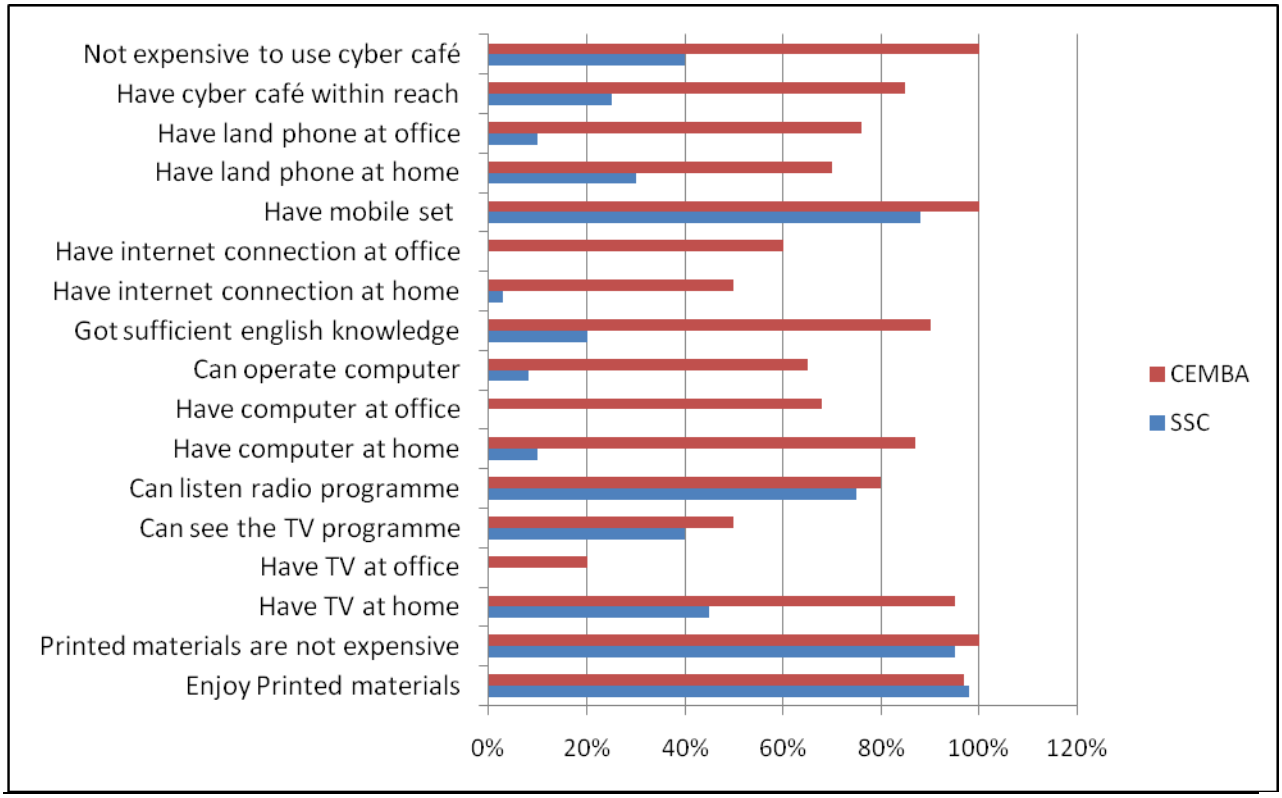
Technologies	Used in SSC Programme and others	Used in CEMBA Programme
Print	Printed textbooks, manuals, etc.	Printed textbooks, manuals, assignments, etc.
Videoconference	N/A	N/A
Audio-conferencing	N/A	N/A
Videotapes	N/A	N/A
Broadcast video, TV	TV broadcast	TV Broadcast
Video CD-ROM	N/A	N/A
Audiotapes	N/A	N/A
Broadcast Audio/radio	Radio broadcast	Radio Broadcast
Audio CD-ROM	N/A	N/A
Computer videoconference	N/A	N/A
Web-based education	N/A	N/A
Internet chat	N/A	N/A
E-mail	N/A	Information and study materials sending
Telephone	N/A	Mobile & land phone
Voicemail	N/A	N/A

* N/A=Not available/Not-in-use

The table above shows that BOU at the moment is not using most of the modern technologies in its teaching learning process. The following sections explains the appropriateness of BOU's existing technologies and the scope of adopting new technologies in BOU's teaching learning process considering the SMAARTE criteria as benchmark.

6.1. Appropriateness of the ODL Technologies used at BOU: SMAARTE Test

The survey on the sampled learners shows that ODL technologies are not equally appropriate for all the programmes of BOU because the learners' technology profiles or technology readiness are not same for all programmes. The following chart (Chart -1) shows the difference.



Based on the information in Chart-1, the appropriateness of ODL technologies used or may be used by BOU can be judged against the SMAARTE criteria. One of the objectives of this study is to show that the appropriateness of a technology may vary from programme to programme and from one learning environment to another learning environment. That's why, two programmes such as SSC and CEMBA programmes of BOU have been taken into consideration to show the comparison in terms of the appropriateness of technology use. Table-7 below shows the appropriateness of the ODL technologies that are presently in use and those may be used at BOU.

Table-7: Appropriateness of ODL Technologies at BOU – SMAARTE Test

ODL Technologies	Programmes of BOU	Presently in use	Softness (S_1, W_1=0.2)	Manageability (S_2, W_2=0.1)	Affordability (S_3, W_3=0.3)	Accessibility (S_4, W_4=0.2)	Reliability (S_5, W_5=0.05)	Totality (S_6, W_6=0.05)	Efficiency (S_7, W_7=0.1)	ATI	Appropriateness
Print	SSC	√	3	4	5	4	4	4	4	**4**	**Appropriate**
	CEMBA	√	3	4	5	5	4	4	3	**4.2**	**Appropriate**
Video-conference	SSC	N/A	2	2	1	1	2	3	4	**1.6**	**Least appropriate**
	CEMBA	N/A	2	3	3	4	3	3	2	**2.9**	**Fairly Appropriate**
Audio-conferencing	SSC	N/A	3	3	1	1	2	3	4	**2.1**	**Least appropriate**
	CEMBA	N/A	3	3	5	5	3	3	3	**4.1**	**Appropriate**
Videotapes	SSC	N/A	3	2	2	1	2	2	4	**2.1**	**Least appropriate**
	CEMBA	N/A	3	3	5	4	3	3	3	**3.8**	**Appropriate**
Broadcast video, TV	SSC	√	3	3	3	2	3	4	5	**3**	**Fairly Appropriate**
	CEMBA	√	3	3	5	5	3	4	4	**4.3**	**Appropriate**
Video CD-ROM	SSC	N/A	3	2	2	1	2	2	4	**2.2**	**Least appropriate**
	CEMBA	N/A	3	3	5	5	3	3	3	**4.1**	**Appropriate**
Audiotapes	SSC	N/A	3	2	2	1	2	3	4	**2.3**	**Least appropriate**

	CEMBA	N/A	3	3	5	4	3	4	3	**4**	**Appropriate**
Broadcast Audio/radio	SSC	√	3	4	4	5	3	4	4	**4**	**Appropriate**
	CEMBA	√	3	3	5	5	3	4	3	**4.2**	**Appropriate**
Audio CD-ROM	SSC	N/A	2	2	1	1	2	2	3	**1.6**	**Least appropriate**
	CEMBA	N/A	3	3	4	5	3	3	4	**3.8**	**Appropriate**
Computer video-conference	SSC	N/A	2	3	1	1	3	3	4	**1.8**	**Least appropriate**
	CEMBA	N/A	3	3	4	4	4	3	3	**3.6**	**Appropriate**
Web-based education	SSC	N/A	3	2	1	1	3	3	4	**2**	**Least appropriate**
	CEMBA	N/A	3	3	5	5	3	3	3	**4.1**	**Appropriate**
Internet chat	SSC	N/A	3	4	1	1	3	3	4	**2.2**	**Least appropriate**
	CEMBA	N/A	3	4	4	4	3	3	3	**3.7**	**Appropriate**
E-mail	SSC	N/A	4	4	1	1	3	2	4	**2.4**	**Least appropriate**
	CEMBA	√	4	4	5	4.5	4	3	3	**4.4**	**Appropriate**
Telephone	SSC	N/A	3	3	4	3	3	3	4	**3.3**	**Fairly Appropriate**
	CEMBA	√	3	4	5	5	3	3	3	**4.1**	**Appropriate**
Voicemail	SSC	N/A	3	2	1	0	3	3	4	**1.6**	**Least appropriate**
	CEMBA	N/A	3	3	5	3	3	3	3	**3.6**	**Appropriate**

Note: 0=Not at all, 1=Poor, 2=Fair, 3=Better, 4=Nearly perfect, 5=Perfect. N/A=Not in use/Not available.

In Table-7, it is seen that all ODL technologies are not appropriate in a specific learning context. The appropriateness varies from programme to programme, institution to institution or society to society. Table-7 shows that the technologies that seems appropriate for CEMBA programme all of them are not appropriate for the SSC programme because the preparedness (affordabilty and accessibility) of the SSC students for technology use is much poor compared to the students of CEMBA programmes. Interestingly enough, from institutions point of view, even if most of the technologies can efficiently be used in SSC programme, but the appropriateness of their use is very low in this case. Because SSC students are not ready to use them. On the other hand, most of the technologies are low efficient for CEMBA program as the number of students is few in this case. However, almost all technologies seem appropriate for CEMBA in overall sense because the CEMBA students have affordability and accessibility to most of the ODL technologies.

7. Conclusion and Recommendations

Although adoption of new technologies is very important for the advancement of ODL system, choosing a technology inappropriately may be very costly for a developing nation. Because, in developing countries, the margin of error is narrow due to limited resources. Therefore, choosing technology appropriately is always vital for the developing countries. The paper made an attempt to propose some criteria that can be utilized to judge the appropriateness of a technology. The appropriateness of the ODL technologies used or to be used at BOU programmes have been assessed against the proposed SMAARTE criteria for technology choice. It has been seen that not all technologies are appropriate for all the programmes of BOU. For CEMBA programme, more or less all the technologies seem appropriate. On the other hand, a few technologies seems appropriate for SSC programme of BOU as the learners of this programme do not have affordability and accessibility to most of the advanced technologies. However, there are scopes to reduce this gap if BOU takes some steps. Firstly, BOU can try to convince the government to develop the infrastructure for technology all over the country. Secondly, BOU can go for a partnership with concerned private and public organisations to establish required infrastructure for technology use. Thirdly, BOU itself can extend the facilities for technology use at its local and regional centers where the learners can come and access the technologies. Government's commitment and efforts to degitilise Bangladesh may bring a dramatic change in the use of technologies all over the country and consequently, BOU learners will be able to access technologies for more knowledge and information.

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